SUMMARY REPORT:
Community Conversations on Climate and Water

Hosted by Arizona Science Center in Phoenix
May 9, 2009

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Executive Summary
In an effort to improve citizens' access to climate information, increase public climate literacy, and gather information about how NOAA can serve society's needs for climate information, personnel from NOAA's Climate Program Office partnered with the Association of Science-Technology Centers (ASTC) to pilot a new initiative called Community Conversations on Climate. The one-day pilot workshop offered citizens the opportunity to interact directly with climate scientists, local experts, and fellow citizens to learn more about how climate variability and change may affect their lives and livelihoods. Building on this model through ASTC's Communicating Climate Change program, free-choice science learning institutions across the nation aim to offer similar workshops focused on their own local climate impacts.

The kick-off event was held on May 9, 2009, at Arizona Science Center and its focus was on the state's climate and water resources. The aim was to help participants become more conversant in both subjects and to know where to go if they wish to learn more. By our informal measures, the workshop proved highly successful in meeting its goals. A consistent suggestion for improving the model for future workshops was to increase the focus on solutions to climate-related issues.

Introduction

> *"**Dialog** is the single most underutilized tool in the public affairs portfolio, and the one most likely to yield the long-term credibility and success in the communications area of the 21st century."*
>
> —Daniel Yankelovich

The Communications and Education team of NOAA's Climate Program Office (CPO) worked with the Association of Science-Technology Centers (ASTC) and Arizona Science Center to develop and hold a pilot workshop in Phoenix called "Community Conversations on Climate and Water." Held on Saturday, May 9, 2009, the goal of the workshop was to join Arizona citizens with local experts in climate and water, including NOAA personnel, through facilitated dialogs. **The goal** was to help participants better understand the causes and effects of climate variability and change, with a particular emphasis on current and future trends in Arizona's water supply.

Our **desired outcomes** for participants were:

- that they would leave feeling more comfortable with, and conversant in, the subjects of climate variability and change and their combined implications for Arizonans' current and future water supply;
- that they would know who their local climate and water experts are and where to go for more information if they wish to follow up in any way; and
- that they would have a better understanding and appreciation of the ways in which NOAA and its research partners observe and monitor the climate system and, therefore, how we know what we know about natural variability and human-induced changes.

An **overarching goal** was to conduct a pilot test of a model for facilitated public dialogs that science centers around the United States and the world might replicate in their respective venues. Through our partnership, the Climate Program Office Communications and Education team and ASTC aim to initiate a series of many such dialogs, collectively called "Community Conversations on Climate and (blank)"—the blank to be determined by the local host institution based upon whatever climate impact is of most interest or concern to their community. In response to local citizens' interests or concerns, NOAA will continue to identify and provide relevant climate science expertise and data resources needed to frame, inform, and guide these conversations.

Rationale

If citizens wish to employ the most effective methods to conduct business, manage natural resources, and participate in local and national democratic processes, then they will need to be climate literate—informed about and able to hold meaningful conversations on climate-related topics.

We live in a time when the Internet and portable communication devices place ever-greater amounts of information at our fingertips. This flow of information can augment public understanding of climate issues, but it can also contribute to public uncertainty and confusion. Citizens face important climate-relevant choices in their lives and livelihoods. Some business leaders and resource managers are developing long-range plans into which they increasingly factor current and predicted future trends in climate variability and change. Those decision-makers need reliable information to reduce their own, and their community's, vulnerability to climate impacts while also improving their resilience.

As NOAA ramps up its abilities to provide national-scale climate services, citizens will need information about the effectiveness of a range of strategies for federal-to-local engagement. This workshop, which we expect to replicate in at least 12 major science centers across the country, provides an effective model for engaging with science-attentive citizens who multiply NOAA's climate information. Because this type of event attracts educators, professional development providers, and members of the

business community who will share information with their clients, impacts of the workshop will reach beyond the actual participants.

ASC Event Summary

In a one-day workshop, climate communicators, local experts on climate and water, and members of the public learned about and discussed impacts of climate variability and change in Arizona. Local and regional experts shared a range of information and interacted with participants in a panel discussion. In small group conversations, participants discussed their own ideas and questions about climate and climate impacts.

The 6-hour workshop had three main phases:

- An introduction to the causes and effects of global climate variability and change and an immersive dome presentation to set context for Arizona's regional climate and water availability;
- Presentations by, and discussion sessions with, a panel of local experts on climate and water; and
- Small group conversations on selected topics.

The expert panel featured the following speakers:

- **Panel Moderator: Kathy Jacobs,**
  Executive Director of the Arizona Water Institute
  Ms. Jacobs is widely known as Arizona's preeminent expert on issues of climate and water. She is currently working on the National Research Council Study, America's Climate Choices, serving as chair of the Panel on Adapting to the Impacts of Climate Change.
- **Nancy Selover, Arizona State Climatologist, Arizona State University**
  Dr. Selover provided an overview of Arizona's climate, focusing on annual precipitation patterns as well as the range of climate variability observed across the state.
- **Steve Olson, Executive Director, Arizona Municipal Water User's Association**
  Mr. Olson provided information about the range of water sources currently used by cities in the Phoenix metropolitan area, and strategies by which they will attempt to continue serving the growing population all the water they need.
- **Frank D'Agnese, Earth Knowledge, Inc.**
  Dr. D'Agnese provided remarks on water issues in Arizona's rural areas, sharing challenges faced by citizens along the San Pedro River watershed as a case study of multiple stakeholders working together to preserve ecosystems and economic viability along the river.
- **Nancy Grimm, Professor, Arizona State University**
  Dr. Grimm described the ecosystem services that surface water has provided for the Phoenix area through history and the changes brought about by widespread agriculture and infrastructure in the region.

To maximize participants' opportunity to contribute to the conversation and interact with local experts in small group settings, we identified topics for conversation that coincided with questions from participant applications and individual panelists' areas of expertise. Five topics were offered for small group conversations:

- Teaching & Learning about Climate and Water
- Water Policy: Making Smart Decisions for the Future
- Say What? Making the Most of Climate Conversations with Your Neighbor
- Urban Growth: Desert Cities as Ecosystems
- What Can We Do? Actions for Individuals & Groups

See Appendix 2 for the summary reports from each Small Group Conversation.

Lessons Learned

The workshop announcement invited individuals to submit an application to attend the event. The only criteria for selection mentioned was that we intended to select about 40 participants who "represent a range of backgrounds and concerns with respect to water in Arizona." As we had the ability to accommodate everyone who applied, we sent invitations to all applicants. Though we didn't exclude anyone, several **invitees mentioned that they were pleased to be selected**, and this seemed to boost their willingness to contribute to the event.

As organizers, we had some concern about the potential for attrition: the event began early on a Saturday morning and participants had not invested anything that they would lose by not attending. However, of 44 registrants, 39 showed up and those who did not attend sent email explanations with apologies. We attribute this high participation rate to the **high interest level of the self-selected participants and the relevance and importance of the issue at hand.**

Our original target audience was a cross-section of Arizona's water-using public. In actuality, the majority of participants were science-attentive adults who have special interest in climate and water. One lesson learned was that those individuals who are willing to attend a full-day event on regionally relevant climate issues are likely already attentive to these issues. The information needs of such a group would likely have been better met by **more focused, deeper-level content**. Reaching a broader, less committed audience might require shorter and/or staggered events.

The original idea for the event was to promote storytelling as a way for participants to articulate and communicate their values for Arizona's water future. However, we experienced some difficulty combining this innovative idea with current strategies employed for public conversations. For future events, we would **build more directly on the range of models available from communities that actively promote public dialog as an effective method of communication**.

Participants clearly valued presentations given by local experts as well as the **opportunity to interact with these experts** in the question-and-answer session. Identifying a willing expert who will suggest individuals for the panel and serve as a moderator of the expert presentations worked very well. For future events, we plan to identify and work very closely with such a person to select a sufficient breadth of expertise in a minimum number of panelists. In hindsight, **reducing the number of experts from five to three** may have sufficiently covered the content and allowed **more time for interaction.**

The workshop took place while Arizona Science Center was open for business, so our time in the planetarium was strictly limited. The directive that the workshop could not interfere with the science center's revenue stream limited the flexibility of our schedule. We could have used **more time in the planetarium** for participants to interact with presenters about specific graphics and visualizations.

Arizona Science Center provided funds from their Communicating Climate Change grant to pay for participant parking. Snacks, drinks, and lunch for the day were provided through an established contract with the University Corporation for Atmospheric Research.

Facilitators of the small groups had prepared guidelines and ideas for keeping the conversation moving in their sessions. Because we spent additional time on the questions and answer session with experts however, we reduced the amount of time for small group interactions significantly, and facilitators were not able to make full use of their plans. The effectiveness of the prepared guidelines has yet to be tested.

Ideas for Improving Future Climate Dialogs

The most obvious opportunity for improvement is to allow **more time for participant interaction with both experts and with other participants**. Reducing the amount of time spent on the fundamentals of climate science and the number of expert panelists who share information will help on this front. Other options for making more time for interaction include hosting a series of meetings, featuring interaction with one expert at a time, or **providing read-ahead materials so that participants will show up with questions and points for conversation** based on their current understandings. With more time, we anticipate that the small group conversations will become more focused and goal-oriented.

Many participants expressed a desire to **get into discussions about solution options**. One way to facilitate this suggestion would be to combine scientists' presentations and data sets with an overview, such as the immersive visualization session held in the planetarium. Such an approach would allow participants to ask questions of local experts and receive responses that are reinforced by data shown within their spatial context. Moreover, many modern planetariums feature keypads on the arms of their chairs: these could be used as an easy means for participants to signal when they

have questions or don't understand a point. Armchair keypads may also provide a convenient means for real-time data collection for post-workshop analysis and assessment. If scientists' presentations had been included in with the immersive planetarium session, with time for Q&A, then we could have proceeded to facilitated discussions about options for solutions in the period after lunch. We will test this model in future Community Conversations on Climate events.

Another opportunity for improvement is to **re-focus the workshop content for a narrower audience**. Recognizing the science-attentive nature of participants who attended this pilot event, future dialogs could be recast as advanced or professional development sessions rather than as fundamental or overview sessions. **Providing participants with access to annotated presentations** and other resources would enable them to share information NOAA has compiled on climate and climate change.

Our digital video camera failed during the event so we were unable to capture video footage of participants as originally planned. Professional-level videography requires resources beyond the scope of our current team and equipment.

Implementing the suggestions in this section will require additional coordination and lead time among the Communications and Education team and invited panelists. In planning future dialog events, we will search broadly to identify and involve local groups that offer similar content or events and find ways to promote them among groups' constituencies. We will strive to offer experiences and information that complement rather than duplicate the work of local groups.

A planning sequence for conversation events that are tied to recent papers or developments in climate science might look like this:

- Upon notice that a paper will soon be published, communicators work with paper authors to develop a story and visuals for ClimateWatch. In the absence of a new scientific paper, a topic that will be covered by a new story in the magazine could be sufficient to begin this effort. Author or an appropriate expert is invited to develop a face-to-face or remote presentation for a community conversation event.
- Institutions that are interested in hosting a conversation event on this topic begin working with ClimateWatch communicators to plan their event, including identifying local expertise on the topic, local groups who are already involved in the issue, and opportunities for participants to be involved in the issue.
- Visualization developers collaborate with organizers and experts to produce an immersive media experience with embedded data (and analysis tools?) for presentation at the conversation event.

- Once the ClimateWatch story is published, conversation participants receive read-ahead assignment. They use ClimateWatch and NOAA resources to educate themselves on the topic at hand.
- Participants bring foundational knowledge and questions to the event, facilitating substantial conversation and efficient dissemination of information.

Replicating the program in other C3 venues

In order to offer the conversation event at other institutions, organizers from NOAA and C3 staff will need to recognize that all potential venues for Conversations will be different. Each center has its own identity, including size, membership demographics, presence/absence of a dome, level of involvement in climate issues, and if/how they address climate issues in their permanent exhibits and presentations. In the face of these differences, C3 may need to describe a list of basic elements that should be in place to support Community Conversation events.

The Community Climate Conversations should build on the hosting institution's existing programs and exhibits on climate. Informal science research has shown that participants have a more thorough change of attitudes when their experience includes hands-on activities. Therefore, the conversation events should take into account traditional science center experiences about climate where this shows a clear benefit.

To promote synergy between the efforts of the hosting institution and conversation organizers, the decision about which local climate impact or indicator will be the focus of the conversation should be made in consultation with the hosting institution. C3 partners have already identified local issues on which they are working with local scientists, and they may want to maintain their focus on the identified issue.

ASTC, as an organization that encompasses, yet is distinct from, the C3 project, is also interested in Community Conversations on Climate. Therefore, some of the centers that propose to partner with NOAA for Conversation events may not be C3 institutions.

Some institutions that may consider hosting conversation events do not have a dome or a planetarium. C3 staff would like to make sure that these institutions could be served with first-rate content that comes as close as possible to the dramatic immersive presentation developed for Phoenix.

A model to consider for the future would be to hold an extended electronic discussion that begins before the face-to-face conversation event and carries on after the event is over. A strong partnership with local media and written press could facilitate this model. An excellent example of this strategy occurred in Naples, Italy

last year when the science center got involved in the local trash collection crisis there. The science center partnered with "Il Matino," a local newspaper that collected 25,000 letters from readers and identified four major questions that readers were asking. The science center created exhibits, a Web site, and discussion forums based on these four questions. Future conversation events might also consider using social media such as Twitter, texting, or cell phone use to create new forms of dialogues and actions.

Finally, conversations should lead to opportunities for taking action. Too many discussions and dialogues in science centers have had no practical outcome. Conversation organizers and participants should tap their creativity to imagine opportunities for involvement and follow up.

Discussion of Post-Workshop Survey Results

This section presents a brief interpretation of results from the workshop's Exit Survey. See Appendix 1 for a data digest of participant responses.

Of the 29 surveys completed, all respondents indicated that they would recommend this experience to others. Twenty-four people (83%) responded that they were "Highly Likely" to recommend it for others and five (17%) indicated they were "Likely" to recommend it.

Responses to the prompt for most and least valuable sessions of the day varied from person to person. The initial presentation was perceived as "all I need for teaching" by one participant but too detailed by another. Likewise, some participants were very engaged during the question-and-answer session, but others seemed anxious to interact in smaller groups. The large majority of participants expressed high value for the interaction and presentations by local experts as well as the immersive dome presentation. A persistent suggestion for improvement was to allow / encourage questions during presentations and generally provide more time for interaction.

APPENDIX 1 – OVERALL RESULTS of the EXIT SURVEY

Out of 31 attendees, 29 completed and submitted our Exit Survey form for a **response rate of 94 percent.** The questions for which respondents' answers could be quantified are summarized below. Five respondents answered "Likely" to the first question. To check for a pattern in their responses, feedback from those five respondents is color-coded **red** throughout this survey digest.

1. How likely would you be to recommend this experience to others?

Very Likely: ||||| ||||| ||||| ||||| |||| = 24 (83%)
Likely: ||||| = 5 (17%)
Not Likely: = 0 (0%)
No Way: = 0 (0%)

2. What is the main message you are taking away from the event?

(Below are counts of specific mentions. Note: some respondents didn't answer and some indicated more than one thing.)

- Climate change and water issues are important and interlinked issues, and more student / public education / communication is needed: ||||| ||| (8)
- Changes / decisions are needed regarding human activities, climate change, and water management policies: ||||| | (6)
- AZ has a lot of expertise; need more opportunities for them to interact with interested public: ||||| (5)
- Individual actions matter and community engagement / awareness raising efforts can make a positive difference: ||||| (5)
- NOAA has great resources for helping to communicate / visualize climate issues: ||| (3)
- AZ has a serious climate-water challenges but lacks awareness/ political will to address them: || (2)
- Scientists are still focused on climate change issues despite economic issues: | (1)
- No response: || (2)

3. What was the <u>most</u> interesting / valuable part of the day for you?

(Below are counts of specific mentions. Note: In these types of questions, some respondents didn't answer and some indicated more than one thing.)

Panel of experts' Q&A session: ||||| ||||| | (11)
Immersive dome presentation: ||||| ||||| | (11)
Panel of experts' presentations: ||||| ||||| (10)
Small group interactive session: ||||| |||| (9)
PPT Presentation on climate change: ||||| (5)
Enjoyed all parts of the day equally: |||| (4)
Break times with informal interactions: | (1)

Wrap up with group report outs: (0)

4. **Which part of the day did you consider <u>least</u> valuable?**
(Below are counts of specific mentions).
Nothing, it was all good: ||||| ||||| (10)
PPT Presentation on climate change: ||| (3)
Introductory process took too long: || (2)
Panel of experts' Q&A session: || (2)
Immersive dome presentation: | (1)
Small group interactive session: | (1)
Wrap up with group report outs: | (1)
Break times with informal interactions: | (1)
Panel of experts' presentations: (0)

5. What would you do to improve the experience for future participants?
(Below are counts of specific mentions)
More time for group interactions ||||| ||||| ||| (13)
More time for Q&A in sessions ||||| ||||| (10)
Add time for discussion of solutions ||||| |||| (9)
Clarify the day's goals & focus on them |||| | (6)
Allow for more time overall |||| | (6)
Conduct follow-on events for extension |||| (4)
Publicize the event for larger turnout |||| (4)
Provide prior read-ahead information | (1)

6. The immersive dome presentation intended to accomplish the following objectives. Which of these did you feel it did successfully? (Check all that apply)
- Provide immersive experience that offered deeper connections for understanding than 2-D presentations: ||||| ||||| ||||| ||||| ||| (23)
- Connect global circulation patterns to AZ climate ||||| ||||| ||||| ||||| ||| (23)
- Highlight connections among different water issues |||| ||||| ||||| ||| (18)
- Connect climate change projections to water in AZ |||| ||||| ||||| | (16)

7. On a scale of 1 to 5, with 1 = not important and 5 = very important, how important was it to have local experts share their knowledge and interact with participants?
5 = ||||| ||||| ||||| ||||| ||| (23)
4 = || (2)
3 = | (1)
2 = (0)
1 = (0)
No answer = ||| (3)

8. On a scale of 1 to 5, with 1 = not important and 5 = very important, how important is it to have printed information and publications to take home from this type of event?

5 = |||| |||| | (11)
4 = ||| (3)
3 = |||| ||| (8)
2 = || (2)
1 = || (2)
No answer = ||| (3)

9. Science centers are generally thought of as places to visit for fun learning experiences. Please comment on your value for science centers as places for policy-relevant dialog.

Strongly affirmative = ||||| |||| ||| (13)
Affirmative = |||| |||| (9)
Neutral = | (1)
Negative = (0)
Strongly negative = (0)
No opinion = ||||| | (6)

10. Do you have questions about climate and water that weren't answered?

- What are next steps or actions we can do now, or soon, to address climate change and / or water issues in AZ?
- General feeling that we need more education and a climate curriculum.
- How does AZ compare to other cities, and other nations, in its water usage statistics?
- Want more information about AZ's local systems approach to water issues and management.
- Want more information about climate system factors (like Hadley Cells).
- Want to know more about population growth versus water use rates.
- What is going on in global politics about Global Warming? And the Kyoto treaty?
- Clarify the semantics: "Global Warming" vs "Climate Change" vs "Climate variability"

APPENDIX 2 – GROUP BREAKOUT SUMMARIES

I. Teaching & Learning about Climate and Water

A significant number of workshop registrants indicated that they were either formal or informal educators: to accommodate their potential interest in conversing with other educators, we offered a conversation session titled "Teaching and Learning about Climate and Water." Four classroom teachers who teach in grades two through seven and one undergraduate-level instructor participated in the session. LuAnn Dahlman, Frank D'Agnese, and Frank Niepold served as facilitators. In self-introductions, participants identified their **needs related to teaching concepts of climate and water**.

An elementary school teacher who is new to Arizona recounted his (moderately successful) search for information that would help him understand the local issues of climate and water so that he could present them appropriately to his students. He also shared that he had been successful in obtaining a grant from a local group, and he used it to compile materials that would allow him to integrate issues of weather and water into his teaching. He noted that finding **elementary-level materials for addressing climate** was still a challenge.

Another participant shared some feelings of frustration at being discouraged by her administrators from covering issues of climate and water in her classes because she teaches social studies rather than science. Her school insists that she focus on established standards rather than addressing current and future concerns. She expressed a desire to find **materials that would allow her to integrate information about the societal implications of climate change into social studies classes**.

At the undergraduate level, a participant described that she is able to "go green" with as many of her lessons as she chooses. Her biggest need is to find and interpret **authoritative information on climate and water** so that she can pass it along with confidence.

Another elementary school teacher who actively seeks professional development experiences expressed frustration that though she has ample access to interesting lessons about water, she found it almost impossible to fit new material into the curriculum prescribed by state-mandated tests. She also noted that her school's daily practices provide a horrible model of water use for students. As her students' habits and attitudes will likely carry over to their adult lives here in Arizona, she continues seeking **methods and materials that will inspire her students to develop an attitude of conservation and respect for water**.

A middle school science teacher shared her need for **materials that would encourage students to develop personal connections with concepts of weather and climate**. In

the absence of some reason that students should care about these concepts, she had no hope that they would learn anything meaningful about them.

Participants shared successes they have had with Project WET (Water Education for Teachers) activities and discussed how they might modify or supplement them in the light of climate model projections that show less precipitation in Arizona's future. The group expressed an enthusiastic desire to identify **an authoritative source of teaching materials on climate, especially hands-on experiments that only require kitchen-available equipment and consumables**. One participant expressed that the best way to encourage broad use of such activities was to offer **comprehensive materials that provide teachers with all the information and ready-to-copy documents necessary to implement the activity in real classrooms**. The group agreed that if a teacher perceives that they need to spend too much time and energy pre-preparing or modifying materials for a lesson, they are unlikely to use it. The group generally agreed that they would benefit from **ongoing interactions with other educators** on the topics of climate and water. Lastly, participants agreed that **teaching standards—and the tests that have the effect of enforcing them—should be more responsive to current knowledge** so that students will be prepared to participate in solving local as well as global issue of climate and water.

II. Water Policy: Making Smart Decisions for the Future

This session, facilitated by Kate Crawford, of ASTC, had three attendees and one expert, Municipal Water Users lobbyist Steve Olson. The attendees included a local water extension office employee, a concerned citizen, and the C3 staffer from the New Mexico Museum of Natural History. The small size of the group lent itself well to a very informal, discussion-based session rather than the more structured program Kate had planned for a larger group. The objective for the session was to give everyone a chance to articulate their vision for Arizona's future water policy and discuss the values, strategies, and tactics related to this policy future. We agreed that, given the very short amount of time we had, we would not concentrate on a tangible output, but focus on giving each participant a chance to express their thoughts on what they'd learned and continue to process these thoughts with input from Steve and other group members. Kate kept notes to highlight common themes and points of agreement.

Even given the time constraints in planning this session, it might have been a mistake not to ask the group to agree on output. The process might be improved upon by **having a few report-out templates to choose from to anchor the discussion** and to **make participants feel like they were making valuable contributions.**

The panel presentation and large group discussion provided a lot of good material for conversation, and having one of the experts available for a more personal interaction was very useful. Steve struck a good balance of providing excellent feedback and

background information without dominating the conversation or intimidating any of the participants. Ideally, we would have had more time for the session, but the time we did have was still valuable.

III. *Say What?* Making the Most of Climate Conversations with Your Neighbor
Seven participants attended this breakout session, which was facilitated by Nancy Selover and David Herring. David opened the session by pointing out that **people primarily go to *trusted sources* when they seek information** about a given subject. Often that source is a friend, family member, or colleague—someone they know and respect. He recounted a story from *The Tipping Point,* the best-selling book by Malcolm Gladwell, to illustrate his point. In short, David said, everyone has a great capacity to positively influence friends, family, neighbors, and colleagues by becoming more conversant in the subjects of climate variability and change and potential impacts to our water supply. We shouldn't underestimate what can be accomplished on an inter-personal level.

To help frame this discussion, David presented participants with the following list of questions:

- With whom do you imagine you might interact, in everyday situations, about the topics of climate change and/or water?
- What will be your objectives in conversing with them?
- What messages or knowledge would you strive to convey?
- How might you most effectively convey this information?
- Comment on the importance of listening to help you more effectively participate in such conversations.

Participants said they often discuss these subjects with neighbors, family members, students, folks they meet while engaged in outdoor activities. One participant expressed concern that some **people seem to place too much credence on popular secondary sources,** such as Fox News. Folks expressed concern that the media, in general, hasn't helped bring clarity to this issue it focuses too much on the "debate" and presents climate change as an overwhelming problem about which scientists are uncertain or don't agree.

The point was made that people should seek credible, primary scientific sources if they want to understand scientific subjects. The Intergovernmental Panel on Climate Change (IPCC) popular summaries on its series of Climate Change Assessment Reports was cited as a good resource for key talking points. Another participant agreed, noting that scientists are generally regarded as politically neutral whereas other media personalities, such as Al Gore, are seen as politically motivated advocates. Thus, **citing credible, unbiased, authoritative scientific sources is a good idea.**

Participants' **objectives in such conversations would be to motivate others** to become more interested in the subjects of climate and water, and to **encourage them to access and read credible scientific materials.** One participant said a good way to connect with people is to **start by listening** and getting to know them better—such as interests or motives or misconceptions they may have. If you can draw them out and **understand their interests or values,** you're likelier to find ways of linking what is known about climate and water back to what they care about, and in ways they can better appreciate and understand.

One participant proffered that folks generally don't care about global-scale issues. They want to talk about local issues. So a greater effort must be made to **show how global climate change is locally relevant,** both in terms of real impacts happening now and in terms of what can be done locally to address them. Another participant added that **bringing local experts into the dialog** was a great way to bring credibility as this global-to-local linkage is made.

It was stressed that **people should not suppress questions about the science.** On the contrary, science is all about raising and answering questions, particularly about climate. Although there is scientific consensus about the human contributions to climate change, consensus isn't really the standard in science. Rather, emphasis should remain on what the data show, how well scientists are able to interpret and account for what the data show, and with what degree of confidence.

A key point is to encourage people to express their questions about the causes and impacts of climate variability and change, and then to **help them to distinguish credible from non-credible sources of scientific information** as they seek information.

IV. Urban Growth: Desert Cities as Ecosystems

The moderator in this session was Nancy Grimm while Ned Gardiner served as the rapporteur. Participants included an education specialist from Tucson, web designer, former head of ASTC/currently consultant, art/science entrepreneur, University of Arizona faculty member in education/Project WET coordinator, and three others who did not self-identify with a profession.

Nancy Grimm's remarks during the panel presentation prior to the breakout had illustrated that freshwater is not simply a resource for humans to manipulate for their own use. **Because water moves through landscapes and is particularly precious in desert environments, it concentrates natural capital.** Rather than approach the issue of water and Arizona's climate from one point of view, Nancy set the topic in a systems perspective.

- Ecosystems provide services to society for free.
- Trade-offs are implicit in disrupting ecosystem functions.

- Streams provide riparian hot spots for biodiversity and ecosystem services.
- Water is used in urban environments in ways that differ from the surrounding landscape. Understanding water flows in natural landscapes can inform urban planning.
- Cities are ecosystems. We can apply ecosystem concepts to understanding the movement and transformation of matter and energy in urban landscapes.
- The choices people make to use water often detract from other ecosystem components.

Science provides a methodology for quantifying and describing water, hydrology, and freshwater ecosystems as models for a transformed urban ecosystem.

This session was convened with 30 minutes available for discussion before reporting back to all workshop participants. In the interest of using that time effectively, we agreed as a group to work with the proposition that **Phoenix will be redesigned as a world-premier arid city**, demonstrating sustainable urban ecosystem processes through social equity, a transformed economic base, and also aesthetic and social bases for promoting these new practices.

Today, municipalities in Australia, such as Brisbane, are world leaders in how to design an arid city. We did not discuss specific examples, but Brisbane could provide a point of comparison for future discussions about opportunities and options for Phoenix to redesign its layout, economic base, and appreciation of the surrounding desert landscape. Science and policy are well-integrated on the northeastern coast of Australia. Here, onshore of the Great Barrier Reef, tourism is a principal source of income, so there is widespread societal recognition that sedimentation of near-shore waters would detract from the economic viability of the region. Therefore, citizens support an effort that gives grades to regional governments for their efforts and performance measures related to sedimentation from inland waterways. A report card is issued to officials, thus stimulating competition on a regional basis among planners and managers. Politicians, whose tenure in office is often short, therefore get public credit for success or are publicly acknowledged for failure to protect waterways and sedimentation to local embayments[1]. In this context, scientists are given authority to participate in the social and economic viability of the region, so this serves as a powerful example for Phoenicians of how ecologists might work with government and other authorities in the future.

We established two principal desired future conditions for Phoenix. First, we envisioned a future in which Phoenicians become more aware and appreciative of the surrounding desert plain, rock outcrops, and desert adaptations of organisms that live there. This appreciation would yield a new aesthetic that celebrates and promotes desert themes through architectural design and the arts. Second, city

[1] http://vimeo.com/3351077

planners and designers would use ecosystem principles to reshape the city. For example, the structure of natural landscapes would be utilized and replicated. Where water is concentrated, diverse vegetation and animals would be aggregated, thus providing for citizens the benefits of cooler microenvironments and providing other species with migratory pathways and nutrient cycling. The latter are examples of ecosystem function. Other functions that urban riparian zones could serve are storm water retention and infiltration as well as treatment of storm water runoff. Wastewater could also be treated using appropriate water recirculation facilities (see work of David Orr in Oberlin, Ohio or John Todd in Rhode Island or North Carolina). Tempe Town Lake demonstrates the power of water retention for providing near-surface water to nearby, seemingly unconnected ecosystems. Preservation and restoration could help restore a free-flowing Salt River.

Some near-term goals were identified for Phoenicians: reduce outdoor water use; improve the aesthetic attributes of the city; regulate water quality; and improve social equity throughout the city. The human environment in the future should differ to that of today and the recent past. Today's water usage is greater than renewable supplies can provide; tomorrow's should be sustainable. Today's energy subsidies are substantial for many reasons, one of which is the sprawling footprint of its diffuse urban environment; tomorrow's city should be more concentrated in order to lower energy use. Today, there is substantial economic disparity among social classes and parts of the city; tomorrow, there should be more equitable distribution of desirable natural resources such as parks and access to water.

We identified a broad set of solutions for human adaptation in the future Phoenix. Roof and front yard gardens, vertical gardens, and aquaculture could provide decentralized and effective food subsidies to Phoenix. The new industrial base of Phoenix would include a medical industry focused on allergy science and alleviation, water conservation tools and supplies, landscape design methods, building design and fabrication, and, of course, solar power generated from concentrated areas as well as a distributed grid on buildings throughout the city. Landscape design would utilize native plants such as yellow brittlebush, and native xeriscaping. Native pollinators would be promoted through this broad approach to support native desert vegetation. Landscape design professionals would come to Phoenix from around the world to learn about native desert design and landscaping practices.

We noted that other cities in similar climates operate more efficiently with respect to water. Tucson uses a fraction of Phoenix's per capita water rate. Water rates are higher, and ad campaigns have successfully helped citizens to participate actively in water conservation.

The group advocated more centralized authority over water use. Home Owners' Associations could provide water policy oversight and education. Cities and rural

areas could form consortia of water users. Higher water usage rates would promote more conservation.

We noted economic incentives for the recommended changes. Building design would encourage energy conservation. Phoenix could develop a national solar energy hub for the national grid. Phoenix could innovate water treatment, reuse, and rain harvesting techniques.

Riparian zones provide important models for redesigning urban spaces. Nancy had introduced the Indian Bend Wash as a designed ecosystem in an urban setting. By building flood retention into this environment, aesthetic qualities and flood control were balanced within a desirable living environment. This example demonstrates how greater awareness of ecosystem services naturally resulted from establishment of a tangible example of how ecosystem design concepts can generate working urban landscapes.

Dance, visual arts, and music could all celebrate the desert landscape.

V. What Can We Do? Actions for Individuals & Groups

Caitlyn Kennedy and Kathy Jacobs facilitated discussion on "What Can We Do?" in a small group of six participants. Kennedy began the discussion by asking what the group would like to focus on. Are large-scale changes the most effective for sustaining water supply, as well as adapting to and mitigating climate change? Do small changes in individuals' lifestyles make a difference? The resounding answer was that **both large-scale changes and individual actions are necessary to address climate change.**

From developing a "desert ethic" to setting a limit on emissions from power plants and cars, the group wanted to discuss a variety of ways that people can take action to address climate change. We went around the table and each participant offered his or her own ideas and personal experiences. One participant explained how she encourages people to save energy and water in her job as a customer service representative for a landscaping company. She rewards customers who will wait a few days for service so that the company can make several stops in the same town in one day. This practice not only saves energy and emissions, but gas money too.

The participants felt strongly that Arizonans need to learn how to live in the desert. Citizens should know the history of adaptation in the Arizona desert, lessons learned, and the consequences of their lifestyles on the desert ecosystem. Ideas for getting communities engaged included volunteer days in which citizens would actively inform others in their community about conserving water. One participant wanted more information related to climate and water integrated into Girl Scout activities.

The participants discussed various large-scale carbon policies, such as cap & trade schemes and tax incentives, which they thought were the most promising ways to get the business community engaged. One participant felt strongly that large reinsurance companies should push companies to consider climate change risk. The participants felt that improving public climate literacy was essential to enabling a transition to a low carbon-economy.

One way to convey an educational message to the masses is through the mass media. The participants felt that public education about climate change could help people become confident enough about the facts to have conversations about climate change with people in their community. However, because climate change is politically charged, one participant felt that moving the conversation away from climate change might be the more productive way to getting people to relate to climate change. For example, people should integrate climate motivations into topics like air pollution – problems that all citizens can see before their own eyes and hit home because they directly relate to human health and/or safety.

Public service announcements were one of the most discussed methods of communicating to the public. While participants acknowledged that it was important to avoid scare tactics, they thought that appealing to people emotionally would have a great impact. One participant gave an example of a climate change public service campaign by Environmental Defense that resonated with him. A man stands in the path of a speeding train. He moves away and it is revealed that a child stands behind him. The message seems to say that our actions could lead to a risky, uncertain or unfortunate future for our children who will have to live with the consequences of climate change.

The participants did not agree on a message to relay to the public but they pointed to recent public messages about health as proof that these kinds of efforts can successfully inform people. After years of public service announcements and campaigns, most people know that smoking causes cancer and they do not need to know all of the science behind this fact to believe it is true. Can we get to this point with climate change? The best thing about public service announcement, the participants said, is that they can be geared toward children and a younger audience. Children become curious about what they see on TV and talk to their parents, who then investigate the subject for themselves.

Although the group spent a lot of time discussing the best ways to communicate messages and educate people about taking action, there wasn't enough time to get into the specifics of "What Can We Do?" The facilitator pointed out several articles in *Sustainability for Arizona: The Issue of Our Age* that explored actions that individuals and groups can take to address future impacts of climate change.